ANALYSIS OF FACTORS AFFECTING FRESH MILK CONSUMPTION AMONG THE MID - COUNTRY CONSUMERS

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ABSTRACT

This study focused on analysing the consumer attitudes, demographic and economic factors that affecting fresh milk consumption among the mid-country consumers of Sri Lanka. Data were collected through a consumer survey conducted in Kandy district at randomly selected super markets, groceries, milk bars and retail shops. Factor analysis was carried out in order to weigh up the consumer attitudes and factor scores were introduced to the final model as independent variables which can be categorized as cost and usage, nutrition, sensory factors and availability. An ordered logistic regression was carried out to find out the relationships between number of demographic and socio-economic characteristics of consumers such as age, gender, level of education, income, size and composition of the household, ethnic group and presence of diseases that affect fresh milk consumption. Results from estimation of a ordered logistic regression model of consumption show age of the respondent, cost and usage related attitudinal factor and Nutrition related attitudinal factors are the key determinants of milk consumption levels; however, household monthly income, health problems affect on fresh milk consumption and level of education play a more important role in consumption. Finally, these findings suggest the marketing strategies which are most suitable to fit with the consumer expectations.

INTRODUCTION

The dairy industry is one of the most important industries of the country that has tremendous potentials in developing the economy. Milk is a unique food item that needs to be available in the market without any shortage since it plays a key role in infant feeding and alleviating nutritional poverty in all other age groups (MLDRI 1995). It has been perceived by consumers as an important source of nutrients, especially calcium for good bone and teeth health (Bus and Worsley 2003; Wham and Worsley 2003). Recent medical researches have found out that there are positive correlations between fresh milk consumption and the reduction of risk for coronary heart diseases and strokes (Shaper *et al* 1991; Massey 2001). Fresh milk can also provide benefits in weight management (Zemel 2002).

In Sri Lanka fresh milk consumption is not much significant because majority of the consumers (63%) are used to consume full cream milk powder. Fresh milk consumption is about one percent of the overall milk consumption of the country (Central Bank of Sri Lanka 2005a). In spite of the fact that the Medical Research Institute (MRI) recommends a consumption level of 60-65kg per person per year, the per capita availability of fresh milk is only about 36kg per person per year and it has been confirmed that Sri Lanka has the lowest milk consumption in South Asia at present (MLDEI 2000).

Fresh milk, as a drink, both in and out of the home, has endured ruthless competition from soft drinks and powdered milk. The range of products in the category of soft drinks, packaging and availability has widened and their low material costs enable them to be extensively promoted (Wham and Worsley 2003). Also, there are huge campaigns to promote the consumption of powdered milk in different brand names and hence there is a significantly higher demand for powdered milk.

Though, the demand for powdered milk is high, there is a particular problem that modern science has largely ignored, which is the nutritive value of heat – labile elements in milk. Some nutrients are destroyed by heat and available only in raw form and some of the factors transmitted by milk are thermo - labile. Therefore, the best milk from the nutritional stand point is "fresh milk" (Schmid 2006).

Several studies have shown that the consumption of fresh milk is partly affected due to poor availability, health problems and hygienic conditions. In addition, lifestyle factors have also influenced the habitual food choices of the consumer and some others studies have illustrated that membership of social category such as gender, age, education, occupational status and ethnicity may influence food selection behaviours and the attitudes and believes on which they depend on (Wham and Worsley 2003; Bus and Worsley 2003). Factors influencing consumer attitudes and acceptance of a product may include product attributes, price as

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well as consumer's social demographic and possible interaction between these factors (Peng *et al* 2006).

According to Information Theory (Nelson 1970; Darby and Karni 1973), consumers assess the quality and attributes of a commodity based on three types of information they obtain about that particular commodity namely Search, Experience and Credence characteristics. Search characteristics are those that can be assessed prior to purchase (e. g. appearance of the product), Experience characteristics are those that can be obtained as the product is consumed (e.g. taste of a product) and Credence characteristics are those that can not be discerned by normal use (e.g. healthiness of a product) (Peng *et al* 2006).

Several studies have demonstrated that attitudes and beliefs about a particular food predict their consumption and these appear to overrule other lifestyle factors (Wham and Worsley 2003). There may be attitude factors underlying declining fresh milk consumption that require attention and this may lead to the development of interventions to promote more healthful behaviours.

In this study attention was paid to identify demographic, economic and attitudinal factors that may influence fresh milk consumption of the mid country consumers in order to help to trace the opportunities and potentials in milk industry in Sri Lanka. Increased milk consumption will have strong positive effects on opportunities for domestic production giving the clear comparative advantage that domestic production hold for supplying fresh milk demand.

MATERIALS AND METHODS

In order to arrive at the aforesaid aims, the study was methodically developed to hypothesize that the fresh milk consumption behaviour is associated with demographic, economic and attitudinal characters of the consumers. Thus, to see the impact of these factors on the consumption of fresh milk, a regression analysis was developed as below.

However, there were two issues that needed to be resolved in order to carry out such a regression analysis. First, was the issue of measuring the attitudinal factors as this is associated with number of difficulties, including "unobservable nature" and "subjectivity" of behaviour among individuals. To resolve this difficulty, the study resorted to alternative ways of developing appropriate techniques to

$$\text{Consumption} = \int (\text{Demographic}, \text{Economic}, \text{Attitudes})$$

avoid losing too much information.

Through a review of past studies on fresh milk consumption (Peng *et al* 2006; Bus and Worsley

2003), 11 statements were used to represent attitudinal factor in the above regression. Each statement was given a score by each consumer on a Likert scale of 1 to 7 where, 1 represents strong disagreement and 7 refers to strong agreement (Table 1). To avoid the difficulty in handling a large number of statements in the regression, a factor analysis was conducted to reduce the number of statements in to a smaller number of factors via principle component analysis with Varimax rotation (Malhotra 2005)

The co-variation among the variables was described in terms of a small number of common factors plus a unique factor for each variable. The factor model can be represented as follows:

$$\chi_i = A_{i1}F_1 + A_{i2}F_2 + A_{i3}F_3 + \ldots\ldots\ldots + A_{im}F_m + V_iU_i$$

Where,

$= i^{\text{th}}$ standardized variable

$A_{ij} =$ Standardized multiple regression co-efficient of variable i on common factor j

F = Common factor

$V_i =$ Standardized regression co-efficient of variable i on U

$U_i =$ Unique factor for variable i

$m =$ Number of common factors

χ_i

The factor scores were calculated for the ith factor as,

$$F_i = W_{i1}\chi_1 + W_{i2}\chi_2 + W_{i3}\chi_3 + \ldots\ldots + W_{ik}\chi_k$$

Where,

$F_i =$ Estimate of ith factor

$W_i =$ Weight of factor score coefficient

$k =$ Number of variables

Each factor formed a score that serves as an independent attitude variable in the above fresh milk consumption behaviour model.

The second issue that had to be resolved was the issue of measuring the consumption in a reasonable manner as the exact consumption levels were hard to obtain. However, since the consumers were able to correctly specify their frequency of consumption, it was used as the dependent variable in the model. As the consumer's frequency of fresh milk consumption was categorized into four categories which suits for ordinal rankings, the use of a technique that can handle this type of qualitative variable was imperative and therefore ordered logistic regression was applied in this analysis.

Degree of fresh milk consumption of individual consumers was quasi-observed and can be decom-

posed in to a deterministic component and additive stochastic component (Borooah 2002; Pampel 2000)

$$D_i = \sum_{k=1}^{k} \beta_\kappa X_{\iota\kappa} + \Sigma_i = Z_i + \Sigma_i$$

Where

D_i was the consumer's degree of fresh milk consumption,

k factors (determining variable) whose values, for individual i,

were X_{ik}, k= 1…k, β = k is the coefficient associated with the kth variable.

The relationship between D_i and the ordinal likelihood ranking Y was a function of cut-off points or thresholds, δ' s which are known and can be estimated along with β's. Hence the dependent variable can be expressed as,

$Y_i = 1$

$Y_i = 2$ if $D_i \leq \delta_1$

$Y_i = 3$ if $\delta_1 \leq D_i \leq \delta_2$

$Y_i = 4$ if $\delta_2 \leq D_i \leq \delta_3$

The probabilities of Y_i if $D_i \geq \delta_3$ taking values 1, 2, 3, and 4 given by,

$$Pr(Y_i = 1) = Pr(\varepsilon_i \leq \delta_1 - Z_i)$$
$$Pr(Y_i = 2) = Pr(\delta_1 - Z_i \leq \varepsilon_i \delta_2 - Z_i)$$
$$Pr(Y_i = 3) = Pr(\delta_2 - Z_i \leq \varepsilon_i \delta_3 - Z_i)$$
$$Pr(Y_i = 4) = Pr(\varepsilon_i \geq \delta_3 - Z_i)$$

The marginal effects of the independent variables on the probabilities were used to explain the model, and they were not identical with coefficients estimated and then depend on the values of all independent variables. The marginal effects of the vari-

ables were calculated for each of the probabilities as follows.

$$\frac{\partial Pr(Y=1)}{\partial X_{ik}} = \frac{d}{d_{zi}}[\Lambda(\delta_1 - Z_i)]\frac{\partial Z_i}{\partial \chi_{ik}} = -\Lambda'(\delta_i - Z_i)\beta_k$$

$$\frac{\partial Pr(Y=3)}{\partial X_{ik}} = \frac{d}{d_{zi}}[\Lambda(\delta_3 - Z_i) - \Lambda(\delta_2 - Z_i)]\frac{\partial Z_i}{\partial \chi_{ik}}$$
$$= [-\Lambda'(\delta_3 - Z_i) - \Lambda'(\delta_2 - Z_i)]\beta_k$$

$$\frac{\partial Pr(Y=4)}{\partial X_{ik}} = \frac{d}{d_{zi}}[1 - \Lambda(\delta_3 - Z_i)]\frac{\partial Z_i}{\partial \chi_{ik}} = -\Lambda'(\delta_3 - Z_i)\beta_k$$

Where,

Consequently, in the context of the relationship between consumers' degree of fresh milk consumption and their demographic, economic and attitudinal factors, the following empirical model was specified (Table 2).

$\Lambda'(x) = \frac{d\Lambda(x)}{dx}$

$$D_i = \beta_0 + \beta_1*AGE + \beta_2* EDU + \beta_3*INC + \beta_4*HHC + \beta_5* HEP + \beta_6 ETH + \beta_7*GEN + \beta_8*HHS + \sigma_1* F_1 + \sigma_2*F_2 + \sigma_3*F_3 + \sigma_4*F_4 + \Sigma_i$$

$$D_i = Z_i + \Sigma_i$$

Table 1: Attitude statements used for factor analysis

Statement	Abbreviation
Always purchase milk products available in high price	HCOST
Packaging should be in high quality	QPACK
Brand is a very important factor	BRAND
Taste is very important	TASTE
Fresh milk is more tasty than other processed milk products	FTAST
Appearance of the product is important	APEAR
Always purchase milk products with high nutritional value	HINEU
Fresh milk is convenient source of many important nutrients	CONEU
Nutritional quality of fresh milk is much higher than processed milk products	NEQUL
Poor availability of fresh milk creates me a barrier for consumption	PORAV
Seek to purchase anyhow (without considering difficulties)	ANYHW

Table 2: Variables defined for the empirical model

Symbol Used	Corresponding variable	Remarks
D_i	Ordered variable derived from consumer degree of fresh milk consumption	i = 1 to 4
AGE	Age of the respondent	Continuous variable
INC	Household monthly income	If > 30,000 = 1 otherwise = 0
HEP	Health problems affect on fresh milk consumption	If present =1 otherwise = 0
ETH	Ethnicity	If Sinhalese = 1 otherwise = 0
HHC	Household composition	If children < 7 years are present = 1 otherwise = 0
EDU	Education level	If never attend to school = 0, if primary only = 1, if secondary only = 2, if tertiary = 3
HHS	Household size	Continuous variable
GEN	Gender of the respondent	If male = 1 otherwise = 0
Explanatory variables to represent attitudes derived from factor analysis		
F_1	Cost and usage related attitudinal factor	Factor score
F_2	Sensory factor	Factor score
F_3	Nutrition related attitudinal factor	Factor score
F_4	Fresh milk availability related attitudinal factor	Factor score

Table 3: Factor loadings, factor structure

Statement	Factor	Loading
QPACK	Cost and usage (f_1)	.753
HCOST	Cost and usage (f_1)	-.654
BRAND	Cost and usage (f_1)	.630
APEAR	Sensory (f_2)	.763
TASTE	Sensory (f_2)	.734
FTAST	Sensory (f_2)	-.550
CONUE	Nutrition (f_3)	.747
HINEU	Nutrition (f_3)	.678
NEQUL	Nutrition (f_3)	.660
PORAV	Availability (f_4)	.742
ANYHW	Availability (f_4)	-.641

Data Collection and Questionnaire

A questionnaire based survey was conducted with a sample of 115 randomly selected consumers to reflect various socio- economic characteristics during the period of April to June 2007.Questionnaire was pre- tested prior to the actual survey with a small sample of potential consumers (n = 20) and minor modifications were done to the preliminary questionnaire. The main survey was carried out in supermarkets, groceries, milk bars and retail shops at the areas of Kandy district.

11 attitude items were selected for inclusion in the survey questionnaire to reflect the four main themes of consumer interests in fresh milk, which are sensory factors, health and nutrition, cost and usage and availability (Caswell 1998; Wham and Worsley 2003).

Using Seven point "Likert scale", the frequency of fresh milk consumption was measured and responses were recorded as daily, occasionally, rarely or not at all.

Data Analysis

Ordered Logit (OLOGIT) via statistical package of STATA 8 was used to find out the respective relationships between the degree of fresh milk consumption and different demographic, economic and attitudinal factors of the individual consumers.

Estimates of log odds (Logits) cut off points and the probabilities derived for the independent variable of each model and marginal effects were used to interpret the nature of each explanatory variable and the relative size and sign of its effect.

RESULTS AND DISCUSSION

Attitudes on Fresh Milk Consumption

Factor analysis of the 11 individual attitude statements revealed four factors (Table 3). In the rotated factor matrix, factor 1 has high coefficients for variables, QPACK (packaging should be with high quality), BRAND (brand is a very important factor) and a negative coefficients for HCOST (always purchase products available in high price). There-

Table 4: Results of the ordered logistic regression

variable	Coefficient	Standard error	(P>|Z|)
_cut 1	1.628743	1.196282	
_cut 2	3.482099	1.231179	
_cut 3	6.709388	1.3664	
AGE	0.078028***	0.0192923	0.000
INC	1.113861***	0.4788455	0.020
HEP	-.99913***	0.4417731	0.024
ETH	-.911044*	0.5515682	0.099
HHC	0.7119378 *	0.3680675	0.053
EDU	0.63586 ***	0.2439572	0.009
HHS	0.0317115	0.1406498	0.822
GEN	-.059374	0.4025507	0.883
F_1	-7546678***	0.2171081	0.001
F_2	0.3406058 *	0.2009153	0.090
F_3	1.167511***	0.2433591	0.000
F4	-5196215***	0.208212	0.013

*** =Significance at 1 % level, ** = Significance at 5% level, * = Significance at 10% level

fore, this factor was labelled as a cost and usage factor. Negative coefficient for negative variable leads to a positive interpretation and hence, consumers are reluctant to purchase products with higher price.

Factor 2 is highly related with variables, APEAR (appearance of the product is important), TASTE (taste is very important) and negative coefficient for FTASTE (fresh milk is more tasty than other processed milk products). Negative coefficient for negative variable leads to explain that fresh milk is not tastier than other processed milk products. Therefore, this factor was labelled as sensory factor.

Factor 3 is highly related with variables, CONUE (fresh milk is convenient source of many important nutrients), HINUE (always purchase milk products with high nutritional value) and NEUQL (nutritional quality of fresh milk is much higher than processed milk products). Thus, factor 3 may be labelled a Nutrition factor. Factor 4 has high coefficients for variables, PORAV (poor availability of fresh milk create me a barrier for consumption) and a negative coefficient for ANYHW (seek to purchase anyhow - without considering difficulties). This interprets consumer do not seek to purchase any how. Therefore, this factor was labelled as Availability factor (Table 3).

The categorization of the statements into these four factors is in line with the previous studies (Wham and Worsley 2003) where consumer attitudes were categorized in to sensory factors, cost and usage, health and nutrition and age and gender requirements.

As discussed previously, the attitudes (the four factors) were regressed with fresh milk consumption controlling for other socio economic and demographic variables. The ordered logistic regres-

Table 5: Ordered dependent variable to represent to consumer frequency of fresh milk consumption

Variable	Frequency of consumption	Number of consumers (n=115)	Percentage (%)	Probability
$Y=1$	Not at all	27	23.48	0.2435
$Y=2$	Rarely	30	26.09	0.2609
$Y=3$	Occasionally	43	37.39	0.3652
$Y=4$	Daily	15	13.04	0.1304
Chi^2 χ^2	83.61	Probability	(0.0000)	

sion carried out was found to be significant (Table 5). Thus, this latent variable was captured through identifying the frequency of consumption in the model. The cut off points estimated (Table 4) specify the ordinal likelihood rankings of the frequency of consumption.

Hence, if the latent variable D_i takes the value less than 1.62, the ordinal dependent variable will take the value of 1(do not consume at all). If it is between 1.62 and 3.48 the ordinal dependent variable is 2 (consume rarely). If the D_i is between 3.48 and 6.71, the ordinal dependent variable will take the value of 3 (consume occasionally) and if it is more than 6.71, the consumers consume milk daily (Table 4).

The estimated coefficients and standard errors reveal which factor influence respondents consumption intentions for fresh milk consumption. A statistically significant coefficient suggests that the likelihood of consumption of product will increase/decrease as the response on the explanatory variable increase /decrease (Borooah 2002)

Table 6 shows that marginal effects of each explanatory variable on consumption probability of fresh milk. The marginal effects provide insights in to how the explanatory variables shift the probability of frequency of fresh milk consumption between the four ordinal levels. The following sections discuss the statistical significance of the coefficients and the marginal effects, particularly focusing on the lowest level of fresh milk consumption ($Y = 1$ or not at all).

Demographic Variables
Results for demographic variables are helpful in profiling consumer who is likely to be most interested in fresh milk consumption. Ceteris paribus gender (GEN) and household size (HHS) did not have significant impact on fresh milk consumption. The age (AGE) effect shows that, ceteris paribus, increasing age is associated with an increasing probability of fresh milk consumption.

Ceteris paribus, Ethnic group (ETH) which is dummy variable (given 1= Sinhalese and otherwise = 0) shows negative relationship with the probability of fresh milk consumption. This indicates peo-

Table 6: Marginal effects

variable	Y= 1	SE	Y= 2	SE	Y= 3	SE	Y= 4	SE
AGE	-.008***	.002	-.010***	.003	.016***	.004	.003**	.001
INC	-.106**	.042	-.159**	.073	.210***	.082	.055*	.033
HEP	.118**	.058	.126**	.056	-.206**	.091	-.037*	.020
ETH	.081*	.041	.135	.084	-.169*	.087	-.047	.039
HHC	-.079*	.042	-.098*	.055	.150*	.080	.027*	.016
EDU	-.071**	.029	-.087**	.038	.134**	.054	.024**	.012
HHS	-.003	.015	-.004	.019	.006	.029	.001	.005
CEN	.006	.045	.008	.055	-.012	.084	-.002	.015
F_1	.084***	.027	.104***	.038	-.159***	.049	-.029*	.012
F_2	-.038*	.023	-.046	.029	.071*	.043	.013	.008
F_3	-.130***	.034	-.160***	.049	.246***	.059	.045***	.017
F_4	.058**	.025	.071**	.032	-.109**	.045	-.020**	.010

*** =Significance at 1 % level, ** = Significance at 5% level, * = Significance at 10% level

ple who are Sinhalese, had lower probability for higher frequency of fresh milk consumption and a higher probability of being not consuming the fresh milk frequently. The significant and positive EDU shows that, increasing education level is associated with an increasing probability of fresh milk consumption. Furthermore, table 6 shows that the probability of fresh milk consumption increases with the household composition (HHC).

Economic and Health Variables
Results revealed that increasing income is associated with an increasing probability of fresh milk consumption, but people who had health problems had lower probability for higher frequency of fresh milk consumption, and a higher probability of being not consuming the fresh milk frequently. Past studies have found that even though, the consumers were made aware of the good health benefits and reducing risk for exposing to diseases, they have not increased the interest on dairy products (Peng *et al* 2006)

Attitudinal Variables
As far as attitudinal factor variables are concerned, the effect of cost and usage shows that increasing cost and usage factor is associated with a decreasing probability of fresh milk consumption. Bus and Worsley (2003) found out that respondents agreed that fresh milk is expensive and this may be a barrier to milk consumption, especially among people in lower income groups. Glenz *et al*. (1998) found out that after taste, cost was the most important influence on food choice. The study also showed that participants in a community wellness programme in the USA said they would drink more milk if it were less expensive.

Consumer attitudes about the availability factor of fresh milk appeared to have negative impact on their consumption which does not directly represent the availability. Furthermore, this factor showed a

negative impact with consumption since it appears to represent the poor availability and difficulties occur due to poor availability.

Nutrition related attitudinal factors shows positive relationship with the fresh milk consumption, which means ceteris paribus increasing level of positive attitudes about nutrition value, is associated with an increasing probability of consuming the fresh milk frequently. Previous studies also found that 95% of consumers believe that certain foods have benefits that go beyond basic nutrition and may reduce the risk of certain diseases or improve their overall health. Although consumers are aware of such health benefits, they still evaluate all other product attributes based on their perception of taste, naturalness, appearance and price (Teratanavat and Hooker 2006)

Moreover sensory factor related attitudinal variable factor showed that positive relationship with the probability of fresh milk consumption is associated with an increasing probability of fresh milk consumption. According to Bus and Worsley (2003) taste is a major determinant of food choice. They found out that the more than 73% of consumers had positive attitudes towards the taste of milk. However, previous studies have shown that perception about taste of milk is influenced by the fat content. For example, preferred whole milk to skimmed milk, and that the sensory score fore liking increased with increasing fat content. Regulating grain dormancy and germination functioned by the involvement of many genes in the interconnected signal transduction pathway. Hence it may be difficult to visualize the effect of each and every gene phenotipically within the present range of GI or germination % even there is allelic differences exist between two parents. Moreover, hexaploid nature of the wheat genome has made the identification of such genes difficult. On the other hand this trait is highly sensitive to environmental factors. Therefore, phenotypic expression of the grain dormancy depends on the interaction between the expressed gene and environmental factors which can exist from development stage to maturation stage of the grain. Under such interactions and under the narrow range of phenotypic evaluation methods those QTLs may not be significant in the same way in every trial. The present study has investigated five putative novel grain dormancy QTLs which lead to the foundation for further breeding studies to practice effective marker-assisted selection aiming at producing PHS tolerant white-grained lines.

CONCLUSION

The findings of the study help to develop policies and marketing strategies which are most suitable to fit with the consumer expectations. The fresh milk marketing companies can modify their targeting strategies from undifferentiated to differentiate which will enable them to provide a better service and earn an outstanding profit.

Further findings of the study imply that fresh milk has become less relevant to peoples' lifestyle, and nutritional benefits of fresh milk are not widely understood. However, since negative attitudes to fresh milk were not existed, that may not limit the potential to make fresh milk an everyday part of modern life. The narrow focus of the perceived nutritional benefits of milk appears to have inhibited fresh milks' popular appeal. Moreover there are opportunities to provide target communication about the health benefits of milk.

This study experience that, different groups would react differently to the frequency of fresh milk consumption. People who are more interested in fresh milk consumption tend to have higher education and income levels. Furthermore there are opportunities to increase fresh milk consumption by reducing the price and increasing the quality simultaneously and the "market" can promote the consumption of fresh milk in Sri Lanka to a greater extent.

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